LINDBERG/BLUE M

Laboratory Vacuum Ovens

Models: VO914A/VO914C
VO1218A/VO1218C
VO1824A/VO1824C
VO914SA/VO914SC
VO1218SA/VO1218SC
VO1824SA/VO1824SC

Installation and Operation Manual

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1 Introduction

The Lindberg/Blue M VO Series is a family of laboratory vacuum ovens designed for drying, curing, outgassing, process control, and applications which require elevated temperature in reduced atmospheres or vacuum/purge with non-flammable gases. Refer to Table 1 on page 2 for specifications.

1.1 Features and Benefits

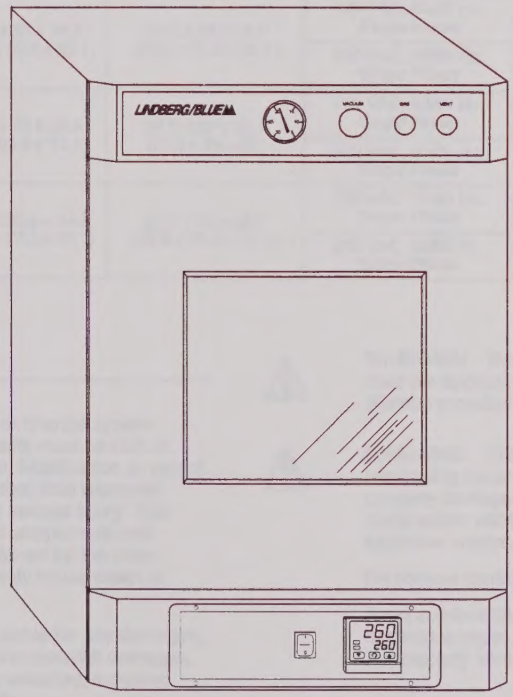
- Single setpoint digital electronic control.
- Built-in overtemperature protection.
- Fully flexible vacuum/purge/release system.
- Vacuum system includes inert gas injection valve, fresh air inlets, vacuum port to exhaust vacuum atmosphere, and controllable vacuum release vent port.

1.2 Available Door Gaskets

In addition to the standard silicone gasket provided with the oven, the following gaskets are available from Lindberg/Blue M:

- Buna-N gasket for use with solvents up to 160°C.
- Viton-B gasket for applications involving acids.

Refer to Table 4 on page 10 for gasket ordering information.



1.3 Specifications

Table 1. Lindberg/Blue M VO Series Laboratory Vacuum Ovens

Model	Dimensions W x F-B x H in. (cm)			Voltage	Exterior	Heater Power (kw)	Shipping Weight lbs (kg)
	Chamber	Exterior	Shipping (Approximate)				
VO914A	9 x 14 x 9 (22.9 x 35.6 x 22.9)	17.5 x 20 x 24.7 (44.5 x 50.8 x 62.7)	27.5 x 30 x 34.7 (69.8 x 76.2 x 88.1)	120 VAC, 50/60 Hz, Single Phase	Enameled Steel	1.05	150 (68)
VO914C				240 VAC, 50/60 Hz, Single Phase			
VO1218A	12 x 18 x 12 (30.5 x 45.7 x 30.5)	20.5 x 23 x 28.4 (52 x 58.4 x 72.1)	30.5 x 33 x 38.4 (77.5 x 84 x 98)	120 VAC, 50/60 Hz, Single Phase		1.55	250 (114)
VO1218C				240 VAC, 50/60 Hz, Single Phase			
VO1824A	18 x 24 x 18 (45.7 x 61 x 45.7)	26.3 x 30.4 x 34.3 (66.8 x 77.2 x 87.1)	36 x 41 x 45 (91.5 x 104.1 x 114.3)	120 VAC, 50/60 Hz, Single Phase		1.55	325 (148)
VO1824C				240 VAC, 50/60 Hz, Single Phase			
VO914SA	9 x 14 x 9 (22.9 x 35.6 x 22.9)	17.5 x 20 x 24.7 (44.5 x 50.8 x 62.7)	27.5 x 30 x 34.7 (69.8 x 76.2 x 88.1)	120 VAC, 50/60 Hz, Single Phase	Stainless Steel	1.05	150 (68)
VO914SC				240 VAC, 50/60 Hz, Single Phase			
VO1218SA	12 x 18 x 12 (30.5 x 45.7 x 30.5)	20.5 x 23 x 28.4 (52 x 58.4 x 72.1)	30.5 x 33 x 38.4 (77.5 x 84 x 98)	120 VAC, 50/60 Hz, Single Phase		1.55	250 (114)
VO1218SC				240 VAC, 50/60 Hz, Single Phase			
VO1824SA	18 x 24 x 18 (45.7 x 61 x 45.7)	26.3 x 30.4 x 34.3 (66.8 x 77.2 x 87.1)	27.5 x 30 x 34.7 (69.8 x 76.2 x 88.1)	120 VAC, 50/60 Hz, Single Phase		1.55	325 (148)
VO1824SC				240 VAC, 50/60 Hz, Single Phase			

2 Safety Considerations

WARNING! Do not modify or change system components. Replacement parts must be O.E.M. exact replacement equipment. Modification or use of the equipment in a manner other than expressly intended may cause death or serious injury. This includes use of user-supplied components and materials not specifically designed for the oven. Reconfiguring the controller may cause death or serious injury.

Lindberg/Blue M shall not be liable for any damages, including incidental and/or consequential damages, regardless of the legal theory asserted, including negligence and/or strict liability.

Before using, user shall determine the suitability and integrity of the product for the intended use and that the unit has not been altered in any way. User assumes all risk and liability whatsoever therewith.

WARNING! Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) provided with your oven.

WARNING! This unit is not intended for use in processing hazardous work loads. Fatal injuries and property damage can result from processing combustible volatile fluids or materials which emit explosive vapors.

Do not use combustible gases in this oven.

Avoid combustible products which generate toxic or hazardous vapor or fumes. Work should only be done in a properly vented environment.

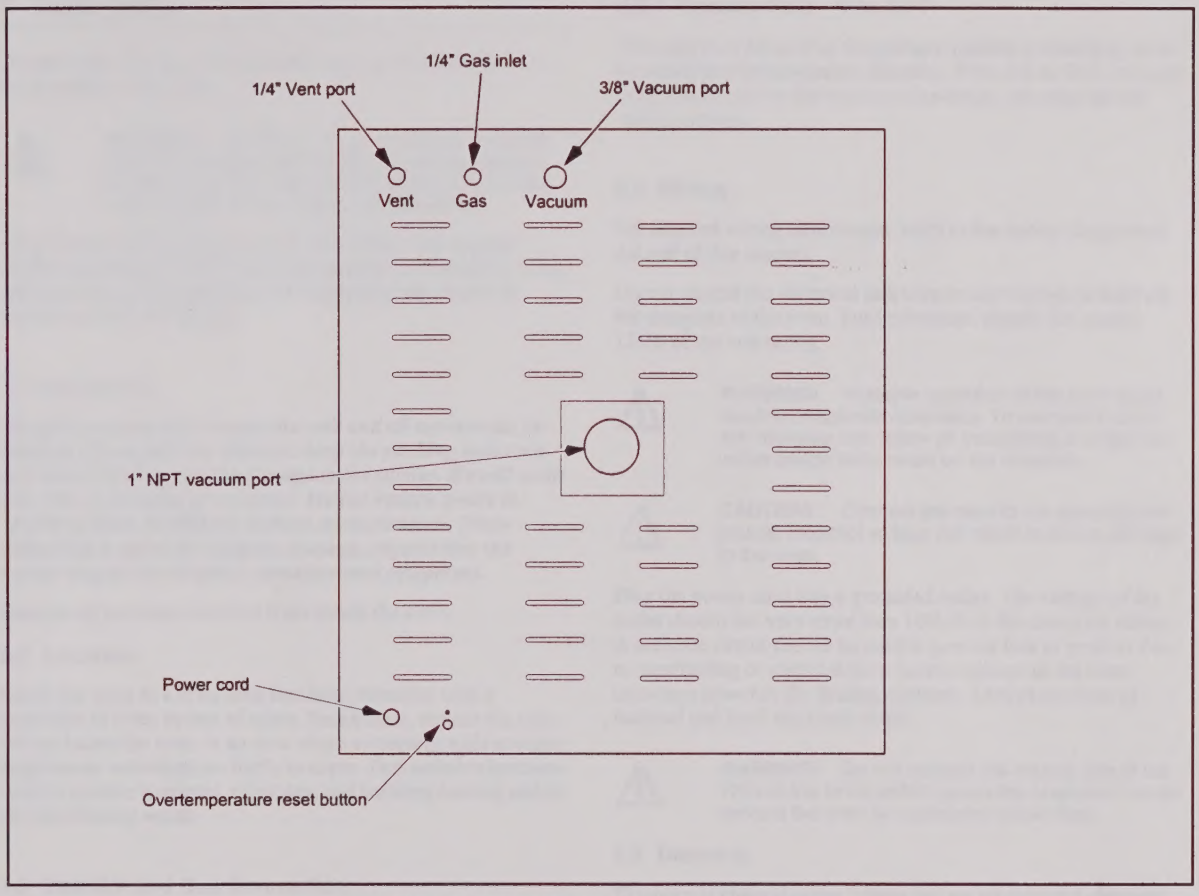


Figure 1. Vacuum and Gas Connections

CAUTION! This product contains fiberglass wool or other refractories which can result in the following:

- May be irritating to skin, eyes, and respiratory tract.
- May be harmful if inhaled.
- Possible cancer hazard based on tests with laboratory animals. Animal studies to date are inconclusive. No human exposure studies with this product have been reported.

WARNING! Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) at the back of this manual.

WARNING! When installing, maintaining, or removing the refractory insulation, the following precautions will minimize airborne dust and fiber:

- Keep personnel not involved in the installation out of the area.
- Use a good vacuum to clean area and equipment. Use a dust suppressant if sweeping is necessary. Do **not** use compressed air.
- Use disposable mask suitable for nuisance dust.
- Wear long sleeve clothing, gloves, hat, and eye protection to minimize skin and eye contact. Do not wear contact lenses.
- Thoroughly wash self after work is complete.
- Launder work clothing separate from other clothes and thoroughly clean laundering equipment after use. If clothing contains a large amount of dust and/or fiber, dispose of rather than clean.
- Promptly place used fiberglass parts and dust in plastic bags and dispose of properly.

3 Installation

Do not exceed the electrical and temperature ratings printed on the dataplate of the oven.

WARNING! Improper operation of the oven could result in dangerous conditions. To preclude hazard and minimize risk, follow all instructions and operate within design limits noted on the dataplate.

All standard Lindberg/Blue M Vacuum Ovens are shipped electrically complete. the only requirements for placing the oven into operation are positioning and connecting the electrical service and vacuum piping.

3.1 Unpacking

Carefully unpack and inspect the unit and all accessories for damage. If you find any damage, keep the packing materials and immediately report the damage to the carrier. We will assist you with your claim, if requested. **Do not return goods to Lindberg/Blue M without written authorization.** ***When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment.***

Remove all packing materials from inside the oven.

3.2 Location

Install the oven in a level area free from vibration with a minimum of three inches of space, for air flow, around the unit. Do not locate the oven in an area where extremely wide ambient temperature variations are likely to occur. This includes locations close to outside windows, entrances, and building heating and/or air conditioning vents.

3.3 Vacuum and Gas Connection

Figure 1 on page 3 shows the back of the oven where the vent tube inlet, gas tube inlet, vacuum tube inlet, vacuum port, power cord, and overtemperature reset pushbutton are located.

3.3.1 Vent Tube Inlet – 1/4 in. O.D.

This tube normally remains unconnected.

3.3.2 Gas Tube Inlet – 1/4 in. O.D.

If required by the material in process, connect this tube to an inert gas supply. The recommended inert gas supply pressure is 4 to 5 p.s.i.g. Do not exceed 10 p.s.i.g. supply pressure.

3.3.3 Vacuum Tube Inlet – 3/8 in. O.D.

This tube may be connected to house vacuum or an independent vacuum pump. If the 1 in. MPT vacuum port is used as the vacuum connection, this 3/8 in. tube may remain unconnected.

3.3.4 Vacuum Port – 1 in. NPT

This pipe may be used as the primary vacuum connection, or as an access port to the vacuum chamber. If the 3/8 in. O.D. vacuum tube inlet is used as the vacuum connection, this pipe should remain capped.

3.4 Wiring

For detailed wiring information, refer to the wiring diagrams at the end of this manual.

Do not exceed the electrical and temperature ratings printed on the dataplate of the oven. Fuse protection should not exceed 125% of the unit rating.

WARNING! Improper operation of the oven could result in dangerous conditions. To preclude hazard and minimize risk, follow all instructions and operate within design limits noted on the dataplate.

CAUTION! Connect the oven to the correct power source. Incorrect voltage can result in severe damage to the oven.

Plug the power cord into a grounded outlet. The voltage of the outlet should not vary more than 10% from the dataplate rating. A separate circuit should be used to prevent loss of product due to overloading or circuit failure. Lower voltage to the oven decreases power to the heating element. Always conform to national and local electrical codes.

WARNING! **Do not** connect the neutral side of the 120 volt line to the unit for grounding purposes. Do not connect the oven to overloaded power lines.

3.5 Cleaning

The oven is cleaned at the factory but we recommend cleaning the oven before initial operation. To clean the oven, complete the following steps:

1. Remove all interior parts, including the shelves and the shelf assembly.
2. Use acetone, alcohol, or ether to thoroughly clean the inside of the oven chamber, including all corners.

The oven should be cleaned periodically to prevent contamination.

3.6 Connections

Connect all vacuum lines and any accessories such as the foreline trap and the exhaust demister per the manufacturer's instructions.

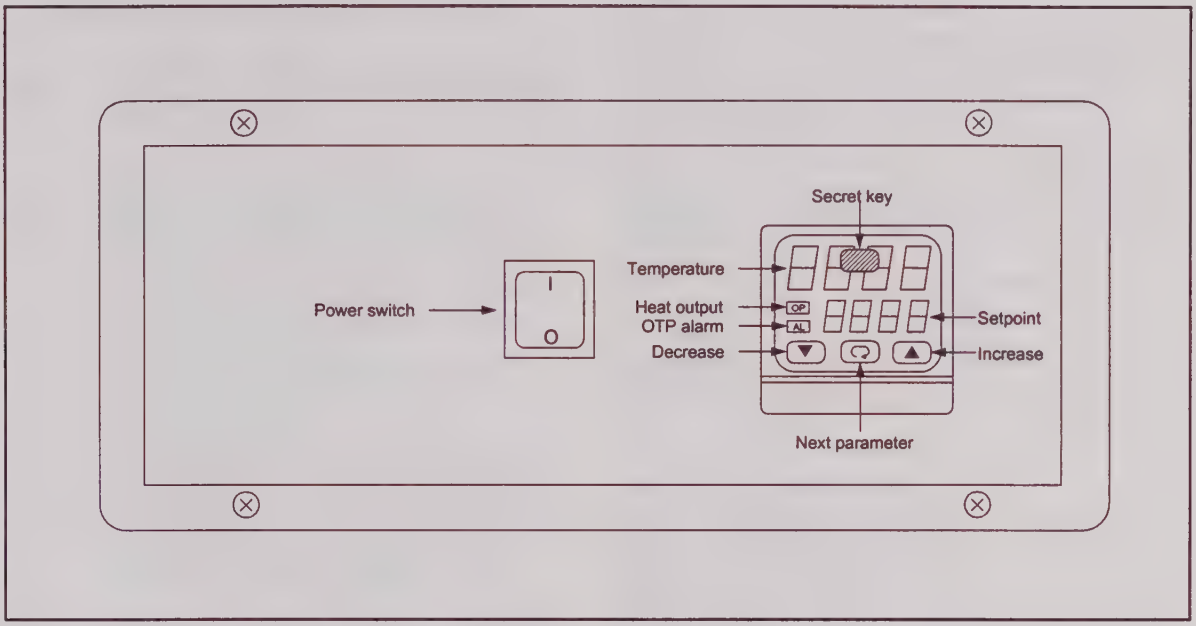


Figure 2. Controller Panel

4 Start Up

CAUTION! Observe the following precautions when operating the oven:
- Wear protective eyeware.
- Wear protective gloves.
- Use tongs to insert and remove oven load.
- Do not allow the load to touch the oven walls.

CAUTION! Do not attempt to operate the oven above the maximum rated temperature of 260°C. Operation above 260°C can cause damage to the oven.

This section provides basic oven start up directions. Refer to Section 5 on page 6 for information about the Eurotherm 91e Controller.

4.1 Oven Start Up

To start the oven, complete the following steps:

1. Turn on main power switch. Wait until the controller runs initial diagnostics. Refer to Section 5 on page 6 for detailed information about controller operation.
2. Verify the vacuum pump connection (see Section 3.3 on page 4).
3. Press any key to illuminate the ▲, ▼, and ↻ keys.
4. Press ▲ or ▼ until the desired setpoint shows on the bottom line of the display. Refer to Section 5.2 on page 7 for additional information.
5. Press ↻ until **AL.SP** (alarm setpoint) shows on the top line of the display. Then press ▲ or ▼ to set the temperature controller alarm (typically 5°C above the main temperature setpoint). Refer to Section 5.3 on page 7 for additional information.

Note: *The high limit alarm in the temperature controller disables the heater output if the oven temperature reaches the alarm setpoint. Although there is no audible alarm, the heater output is disabled once the oven temperature reaches alarm setpoint.*

6. Start the vacuum pump.
7. The vacuum, gas, and vent valve controls are located on the top front panel. All these controls turn counterclockwise to open. Close the vent and gas valves and fully open the vacuum valve.
8. If the oven fails to heat up to the setpoint, press the overtemperature reset button on the rear of the unit. If the oven still fails to operate, contact the service department.

4.2 Vacuum Release

To release the vacuum when a test is complete, close the vacuum valve and open the vent valve just enough to overcome the vacuum. Continue to open the vent valve slowly until the vacuum is released.

5 Operation – Eurotherm 91e Controller

WARNING! Before operating this equipment, read the applicable MSDS (Material Safety Data Sheets) at the back of this manual.

WARNING! When installing, maintaining, or removing the fiberglass insulation, the following precautions will minimize airborne dust and fiber:

- Keep personnel not involved in the installation out of the area.
- Use a good vacuum to clean area and equipment. Use a dust suppressant if sweeping is necessary. Do **not** use compressed air.
- Use disposable mask suitable for nuisance dust.
- Wear long sleeve clothing, gloves, hat, and eye protection to minimize skin and eye contact. Do not wear contact lenses.
- Thoroughly wash self after work is complete.
- Launder work clothing separate from other clothes and thoroughly clean laundering equipment after use. If clothing contains a large amount of dust and/or fiber, dispose of rather than clean.
- Promptly place used fiberglass parts and dust in plastic bags and dispose of properly.

The oven temperature controller is configured and tuned at the factory to function well for most applications. Occasionally, it may be advisable to configure the temperature controller differently to suit a particular working environment or process.

CAUTION! Before reconfiguring the controller, read this chapter and the Eurotherm 91e manual. Reconfiguring the controller can change the unit characteristics and design parameters, which can hamper performance and make the equipment dangerous to use.

This chapter provides brief instructions on how to perform the following configuration changes:

- Setting the Temperature.
- Setting the Overtemperature Protection Temperature.
- Changing Between Celsius and Fahrenheit.
- Setting the Ramp to Setpoint Time.

Detailed instruction on configuring the temperature controller are found in the Eurotherm 91e manufacturer's manual.

5.1 Normal Controller Operation

The Temperature Controller senses the process temperature of the oven and supplies the heat necessary to achieve the desired setpoint. The controller includes an LED display and a pushbutton keypad (refer to Figure 2 on page 5).

Refer to Table 2 for a list of LED displays and keypad functions.

The process value or the parameter code displays on the top line. The process value (actual temperature) displays whenever the instrument is unattended.

Table 2. Eurotherm 91e Parameter Functions

Indicator	Function (Default Value or Range)
LED Display	
Conf	Configuration code (6257 for Celsius, 6253 for Fahrenheit).
Id	Model number (91e).
Prop	Proportional band (10).
Int.t	Integral time constant (1800).
dEr.t	Derivative time constant (180).
Ofst	Calibration offset (0.0).
SP.HI	Setpoint high limit (260°C or 500°F).
SP.Lo	Setpoint low limit (0°C or 32°F).
SP.rr	Setpoint ramp rate (off).
H.ct	Output cycle time (1.0).
LP.br	Loop break reaction time (4000).
Line	Line frequency (60 or 50 Hz).
tunE	Self tuning on demand (OFF).
AL.SP	The setpoint which causes the control to go into an alarm condition. Typically set 10 degrees above the highest operating temperature used.
°C or °F	Celsius or Fahrenheit operation (°C).
Pushbutton Keypad	
↻	The scroll key advances the display to the next parameter code and setting. • Press and hold for 10 seconds to access setup menus. • Press to scroll through the setup menu parameters. • Press and hold for three seconds to abort the ramp to setpoint.
▲	The up arrow key is used to increase a setpoint or a parameter setting.
▼	The down arrow key is used to decrease a setpoint or a parameter setting.
Secret Key	The secret key is used to access the protected list parameters from the alarm display (**AL.SP**).

Note: *The three pushbutton keys are not illuminated when the instrument is unattended. Touch any key on the front panel of the controller to light up the keys.*

CAUTION! Do not adjust the setpoint high limit setting above 260°C (500°F).

5.2 Setting the Temperature

To set the temperature to the desired setpoint, complete the following steps:

1. Press any button on the controller keypad to illuminate the ▲, ▼, and ↻ keys.
2. Press ▲ or ▼ until the desired setpoint is indicated on the bottom line of the display.

5.3 Setting the Overtemperature Protection (OTP) Temperature

Note: *The high limit alarm in the temperature controller disables the heater output.*

To set the alarm on the temperature controller (typically 5°C above the desired main temperature setpoint), complete the following steps:

1. Illuminate the keys by pressing any button. Proceed directly to step 2 if the keys are already lit.
2. Press ↻ until **AL.SP** shows on the top line of the display.
3. Press ▲ or ▼ until the desired overtemperature limit setpoint shows on the bottom line of the display.

5.4 Changing Between Celsius and Fahrenheit

To change between Celsius and Fahrenheit display, complete the following steps:

1. Turn power to the controller off and then on.
   The following codes display:
   tESt
   1111
   8888
   XXXX (This will be a four digit configuration code, for example **6253**).
2. When the four digit configuration code displays, press and hold down the "secret key."
3. Press ▼ until the fourth digit flashes.
   For Celsius operation, press ▲ until the number **7** is displayed (Fahrenheit is number **3**).

Note: *Don't change the other three numbers since they will affect the alarm, sensor type, and range limits of the control.*

4. Press the secret key to enter in the new configuration (or press ↻ to abort the procedure).

5.5 Setting the Ramp to Setpoint Rate

To set the ramp to setpoint time, complete the following steps:

1. Press ↻ until **AL.SP** displays.
2. Press the secret key.
3. Keep pressing ↻ until **SP.rr** displays.
4. Press ▲ or ▼ to enter the new value (0.1 to 50°C/minute or 0.2 to 90°F/minute).
5. Press the secret key again to exit the protected list.

Note: *The setting should be within the capabilities of the unit. Some units are factory configured to ramp as quickly as possible.*

When you use the setpoint ramp rate function, the self-tuning feature is disabled and the display does not show **tunE** as an option.

6 Maintenance

CAUTION! Maintenance should only be performed by trained personnel.

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

CAUTION! This product contains fiberglass wool or other refractories which can result in the following:

- May be irritating to skin, eyes, and respiratory tract.
- May be harmful if inhaled.
- Possible cancer hazard based on tests with laboratory animals. Animal studies to date are inconclusive. No human exposure studies with this product have been reported.

WARNING! Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) provided with this unit.

WARNING! When installing, maintaining, or removing the refractory insulation, the following precautions will minimize airborne dust and fiber:

- Keep personnel not involved in the installation out of the area.
- Use a good vacuum to clean area and equipment. Use a dust suppressant if sweeping is necessary. Do **not** use compressed air.
- Use disposable mask suitable for nuisance dust.
- Wear long sleeve clothing, gloves, hat, and eye protection to minimize skin and eye contact. Do not wear contact lenses.
- Thoroughly wash self after work is complete.
- Launder work clothing separate from other clothes and thoroughly clean laundering equipment after use. If clothing contains a large amount of dust and/or fiber, dispose of rather than clean.
- Promptly place used fiberglass parts and dust in plastic bags and dispose of properly.

6.1 General Maintenance

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

Regular maintenance is required to keep the oven running at optimum levels.

1. Clean the oven interior as necessary with acetone, alcohol, or ether.

WARNING! When using cleaning materials, follow all precautions listed on the cleaning containers. Always use cleaning materials in well ventilated areas as inadequate ventilation can be fatal.

Note: *Frequency of cleaning depends on the oven workload. If the oven becomes contaminated, the ultimate vacuum level will not be attained.*

2. Check hose connections for leaks weekly.
3. Check the vacuum pump oil level.
4. Check the condition of the vacuum pump oil. Replace the oil if it is contaminated.

6.2 Gasket Maintenance

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

The door gasket is designed for easy removal and installation. This gasket may come off when the door is opened after high temperature operation or processing of workloads containing resin. To prolong gasket usage, clean the oven to remove any resin.

6.3 Door Alignment

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

The oven may not pump down properly if the door is out of alignment. To realign the oven door, complete the following steps:

1. Lay the oven on its back.
2. Loosen top and bottom hinges.
3. Square the door. Check that the glass comes in contact with the gasket.
4. Place a small amount of pressure (approximately one pound) on the hinges.

Note: *This pressure is required so that the door seals when closed. The glass floats on springs to achieve a complete seal.*

5. Tighten the hinges.
6. Pump the oven down.

7 Troubleshooting

WARNING! Troubleshooting procedures involve working with high voltages which can cause injury or death. Troubleshooting should only be performed by trained personnel.

This section is a guide to troubleshooting oven problems. Refer to Table 3 for troubleshooting procedures.

Table 3. Troubleshooting

Problem	Probable Causes	Solution
Oven shelves warp and discolor.	Oven temperature is above 260°C.	Do not operate the oven above 260°C.
Door gasket comes off.	Gasket is damaged from high temperature operation or from resin damage.	Do not operate the oven above 260°C. Clean oven to remove resin.
System ultimate pressure is high.	Oven is contaminated with high vapor pressure material.	Clean the oven. Refer to Section 6.1 on page 8.
	Pump oil is contaminated.	Change the oil. Use inlet vapor trap and/or gas ballast.
	Leaks in vacuum piping or ports.	Check for leaks in vacuum line, oven port, door.
	Vacuum pump seal is worn.	Replace shaft seal.
	Discharge valve is worn.	Replace valve.
	Internal parts are worn.	Install new vanes.
	Vacuum vent valve is opened.	Close vent valve.
	Oven does not pump down properly due to misaligned door.	Realign the door. Refer to Section 6.3 on page 8 for realignment information.
No vacuum in oven.	Power to pump is off.	Check the power switch and outlet.
	Use of extension cord results in insufficient amperage.	Move the oven closer to power source and do not use extension cord.
	Pump is damaged.	Return the pump to the factory for repair.
Pump stalls.	The discharge line is blocked.	Change the demister and clear the blockage.
	No pump oil or lost viscosity (overheating).	Change the oil.
Long drying time.	The piping is too narrow.	Install piping the same size as the pump inlet.
	The distance between the pump and the oven is too large.	Move the pump closer to the oven or use a larger pump.

8 Wiring Diagrams

The following pages contain the wiring schematics and replacement parts for the VO Series Vacuum Ovens.

Table 4. Replacement Parts

All quantities are one each unless noted.

Oven Model	VO914A VO914SA VO914C VO914SC	VO1218A VO1218SA VO1218C VO1218SC	VO1824A VO1824SA VO1824C VO1824SC
Line Cord (120 V Models)	118971	34732H01	34732H01
Line Cord (240 V Models)	34731H01	34731H01	34731H01
Needle Valve (1/4 in.)	(2) 118970	(2) 118970	(2) 118970
Type J Shielded Thermocouple	(2) 118965	(2) 118965	(2) 118965
Solid State Relay	118966	118966	118966
Switch (Green)	118967	118967	118967
Vacuum Gauge	118972	118972	118972
Temperature Controller	118008	118008	118008
Safety Thermostat	118964	118964	118964
Element	(3) 118968	(3) 118968	(4) 34635H01
Needle Valve (3/8 in.)	118969	118969	118969
Silicone Gasket	118975	38027H01	34636H01
Door Pull Handle, SA and SC Units	38023H01	38023H01	38023H01
Pull Handle, A and C Units	38024H01	38024H01	38024H01
Door Magnet Catch	38025H01	38025H01	38025H01
Levelling Feet	(4) 38026H01	(4) 38026H01	(4) 38026H01
Aluminum Full Shelf	38028H01	(2) 38028H02	(3) 38028H03
Aluminum Half Shelf	38028H04	38028H05	—
Optional Gaskets			
Buna-N Gasket	118974 (9 x 9)	118977 (12 X 12)	34637H01 (18 x 18)
Viton Gasket	118973 (9 x 9)	118976 (12 X 12)	34638H01 (18 x 18)

Figure 3. Wiring Diagram – VO914C, VO914SC, VO1218C, and VO1218SC only

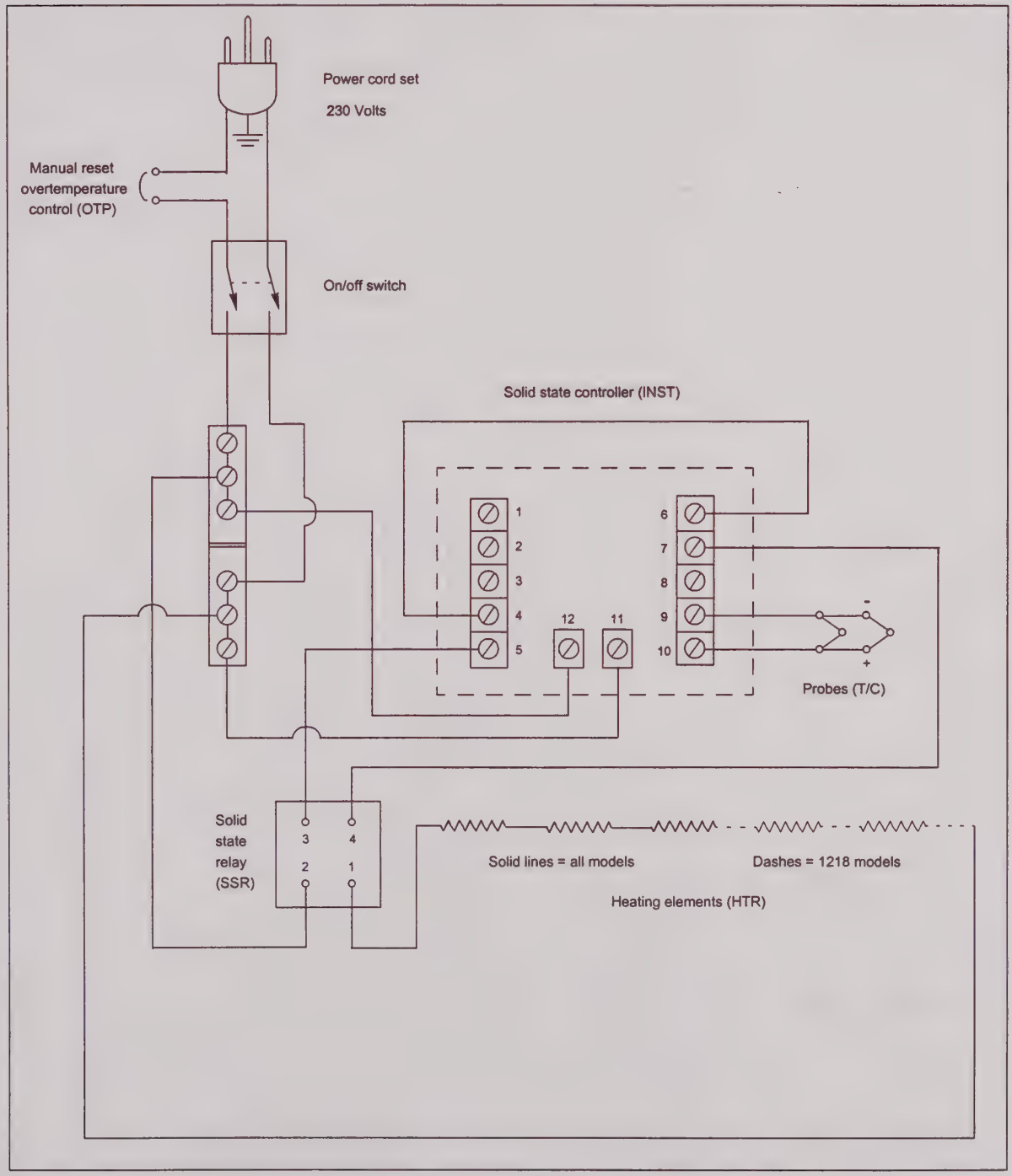


Figure 4. Wiring Diagram – VO914A, VO914SA, VO1218A, and VO1218SA only

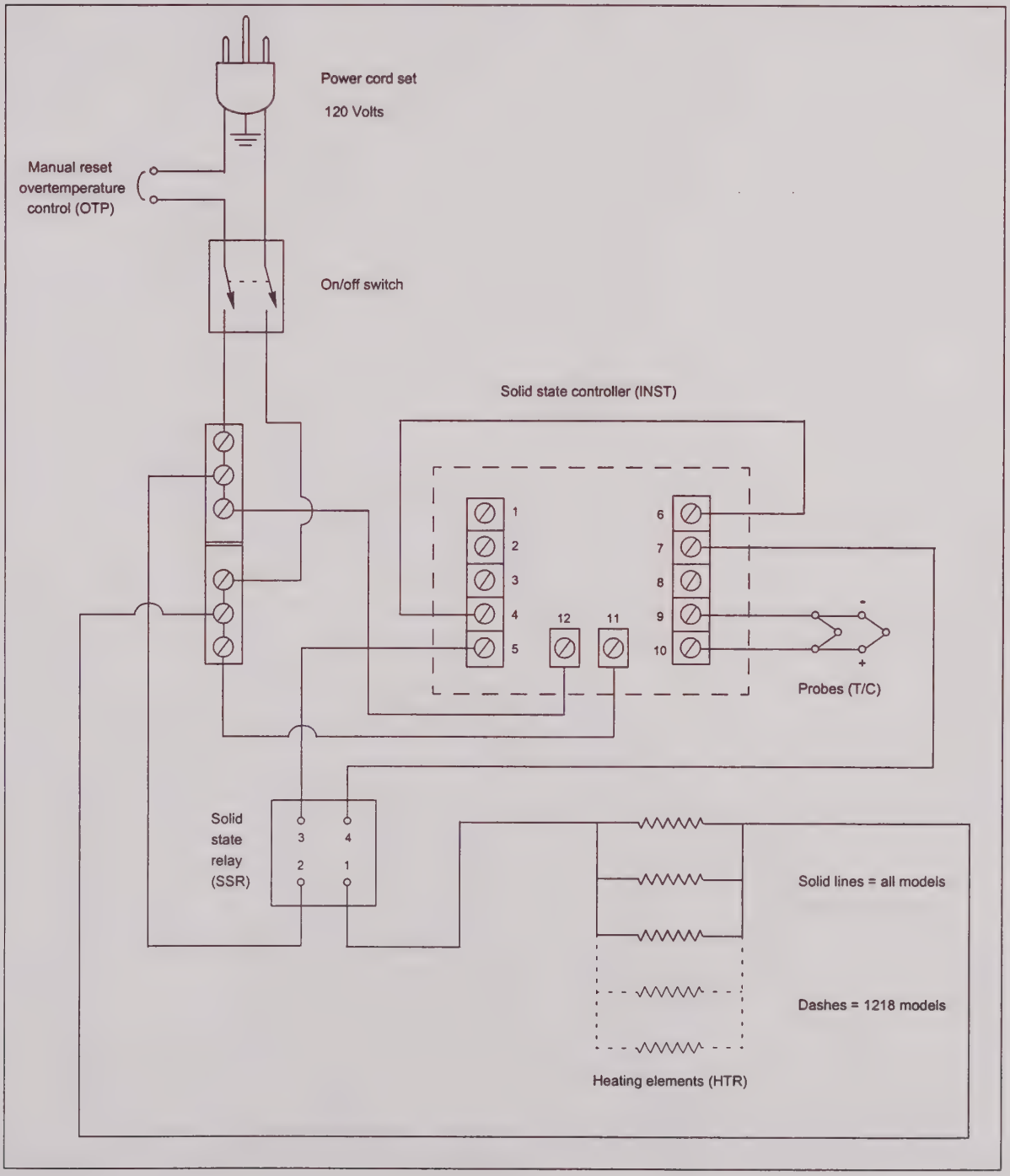


Figure 5. Wiring Diagram – VO1824A and VO1824SA only

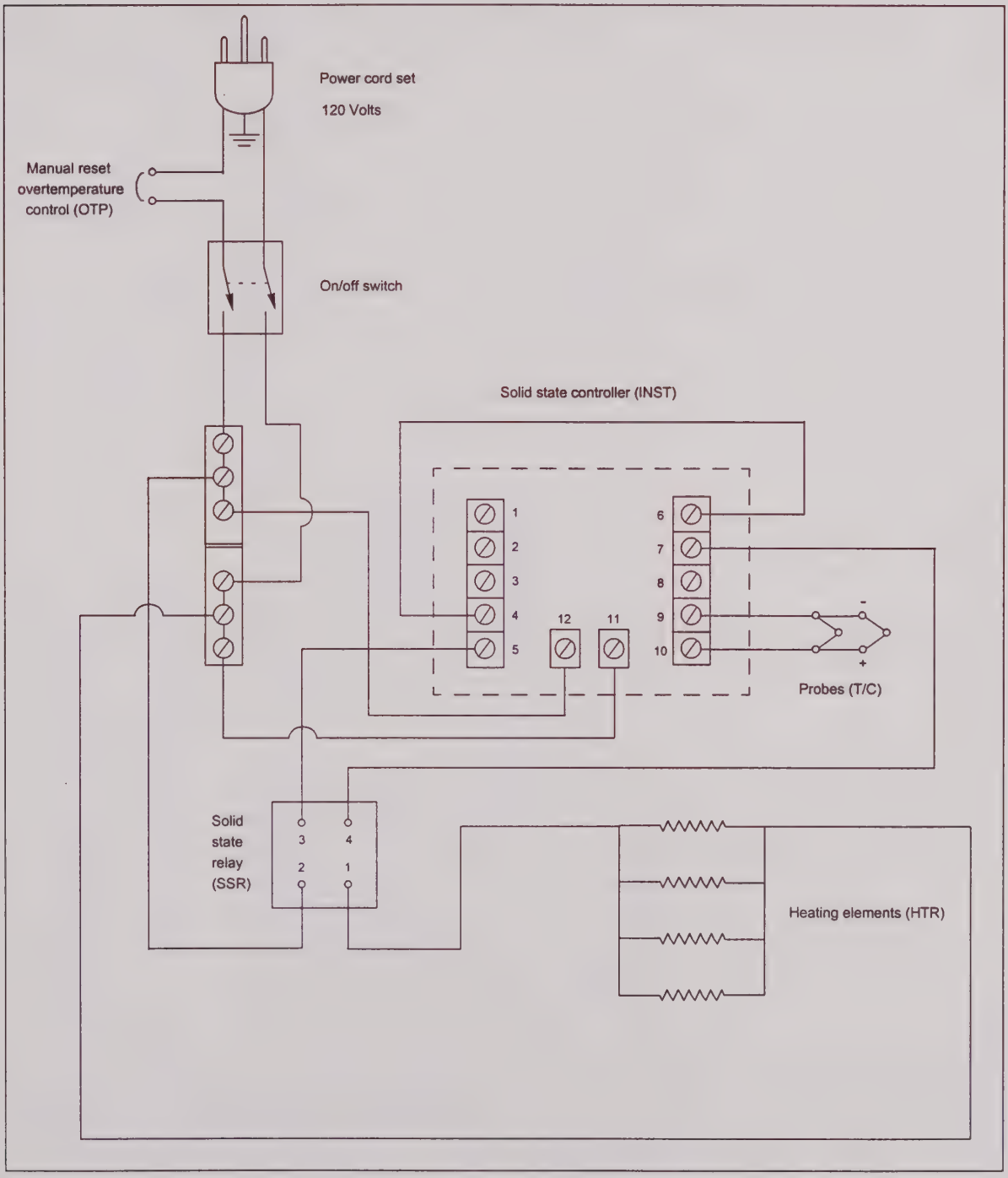
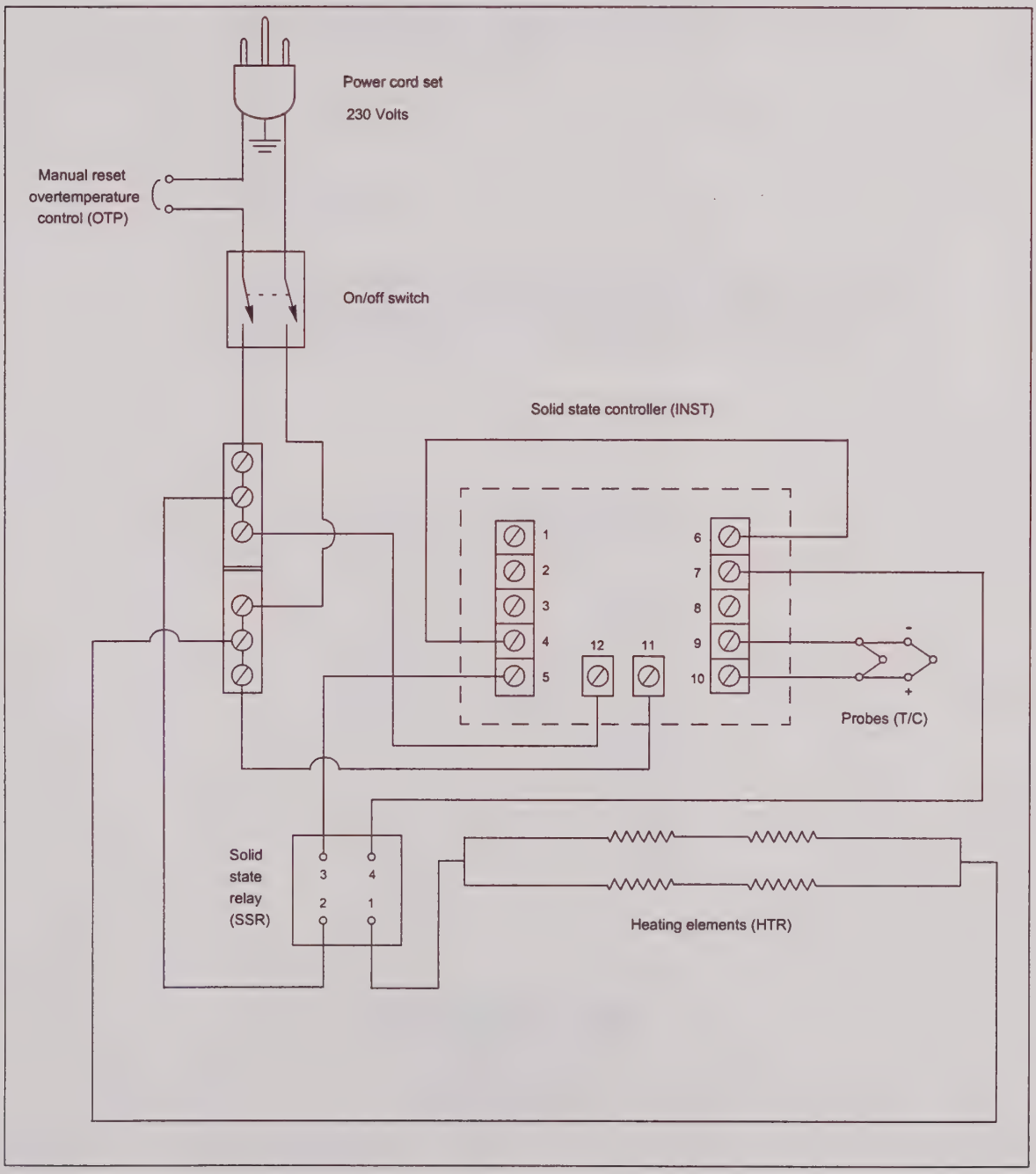


Figure 6. Wiring Diagram – VO1824C and VO1824SC only



Important

For your future reference and when contacting the factory, please have the following information readily available:

Model Number: _____

Serial Number: _____

The above information can be found on the silver dataplate attached to the equipment. If available, please provide the date purchased, the source of purchase (Lindberg/Blue M or specific agent/rep organization), and purchase order number.

IF YOU NEED ASSISTANCE:

LINDBERG/BLUE M SALES DIVISION

Phone:	704/658-2711 800/252-7100
FAX:	704/645-3368

LABORATORY PARTS and SERVICE

Phone:	704/658-2891 800/438-4851
FAX:	704/658-2576

TECHNICAL SUPPORT

Phone:	800/438-4851

LINDBERG/BLUE M

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